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RESEARCH ARTICLE

Estimating The Prevalence of Non-Communicable Diseases and Adherence to Dietary Habits And Physical Activity Among Healthcare Professionals in The Middle East And North Africa Regions

Nael Kamel Eltewacy[1], Nada Abdelhalim[2*)], Tarek A. Owais[3], Saif Salman[4], Nouran Hamza[5], Sheikh Mohammed Shariful Islam[6]

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Abstract

The rising number of fatalities linked to food, exercise, and non-communicable illnesses has sparked interest in studying their effects. In society, Healthcare Professionals (HCPs) symbolize health and wellbeing. However, the incidence of chronic illness and healthy habits among Middle East and North Africa (MENA) HCPs remains unclear. To determine the prevalence of chronic diseases and adherence to healthy dietary habits and physical activity among HCPs in the MENA region. Algeria, Egypt, El Yemen, Iraq, Jordan, Kuwait, Libya, Palestine, Saudi Arabia, Sudan, and Syria HCPs (physicians, dentists, nurses, pharmacists, and nutritionists) participated in multicenter cross-sectional research. April to June 2022 data on diet and exercise habits was collected using a pre-tested self-administered questionnaire. Demographics, risk factors, medical history, and nutrition and exercise were included in the questionnaire. HCP diet and exercise were examined using multivariable regression models. A study of 7130 HCPs (mean age 28.6 ± 7.8 years, 57.5% females) was conducted. Physicians held 56.8% of the sample population, followed by pharmacists, nurses, dentists, and nutritionists. Cardiovascular disease (CVD) affected 33.1% of individuals. Alcohol, pork, soda, sugar, and smoking raised the risk of non-communicable diseases. Nutritionists were the most active HCPs. About half of dietitians (45.3%) walked 150 minutes or more per week, while 14.7% and 25.9% did 150 minutes or more of moderate and 75 minutes or more of intense exercise, respectively. HCPs in MENA had high rates of CVD and risk factors such smoking, alcohol, pork, soda, sugar, and less exercise. MENA HCPs must be aware of the significant incidence of these risk factors to enhance health behavior.

Keywords: Healthcare Professionals (Hcps), Middle East and North Africa (MENA), Cardiovascular disease (CVD), Diabetes Mellitus (DM), Dietary Habits, etc

[1] ENS Paris Saclay Université, Paris, France; Eltewacy Arab Research Group
[2*)] Department of Nutrition & Dietetics, School of Health Sciences, Istanbul Gelişim University, Istanbul, Turkey; Eltewacy Arab Research Group
[3] Faculty of Pharmacy, Benisuef University, Benisuef, Egypt; Eltewacy Arab Research Group
[4] Department of Neurology, Mayo Clinic, Jacksonville, FL, USA; Eltewacy Arab Research Group
[5] Medical Agency for Research and Statistics, Egypt; Clinical Research Key (CRK-CRO), Kenya
[6] Institute for Physical Activity and Nutrition, Deakin University, Melbourne, Australia

*) corresponding author

Nada Abdelhalim

Email: khalednada1998@gmail.com

INTRODUCTION

Cardiovascular disease (CVD) remains a leading cause of mortality worldwide, and its prevalence has been notably increasing in the Middle East and North Africa (MENA) region. Recent reports indicate that 18% to 40% of deaths in countries such as Iraq, Jordan, Syria, and the Gulf states are attributable to CVD, with Saudi Arabia having the highest death rate in the region (Manla & Almahmeed, 2023; Alhabib et al., 2020). However, there is a significant gap in the literature regarding the health and lifestyle behaviors of healthcare professionals (HCPs) in the MENA region. While studies from Western countries, such as the United Kingdom, the United States, and Australia, have provided insights into the dietary and physical activity patterns of HCPs, these findings may not be fully applicable to the MENA region due to distinct cultural, social, and environmental factors (Mehio Sibai et al., 2010; Mittal et al., 2018).

The lifestyle of individuals in the MENA region often mirrors Western consumption patterns, characterized by high-fat diets, low intake of whole grains, fruits, and vegetables, sedentary lifestyles, and prevalent tobacco use (Manla & Almahmeed, 2023). These dietary and lifestyle habits are strongly linked to the development of non-communicable diseases (NCDs) such as type-2 diabetes, cardiovascular diseases, cancer, and mental health disorders, including anxiety and depression (Ojo, 2019). This Westernization of diet and lifestyle is further compounded by cultural and environmental factors specific to the MENA region, such as high rates of consanguinity and unique genetic predispositions, which may exacerbate the risk of NCDs (Nasreddine et al., 2018). Moreover, the rapid urbanization and economic development in the region have contributed to an increase in sedentary behaviors and unhealthy dietary patterns, making it imperative to understand the health implications of these changes among the region's population, particularly among healthcare professionals (HCPs) (Mokdad et al., 2014).

HCPs are a critical population to study, as they not only represent the health and wellness of society but also serve as role models for their patients (Kris-Etherton et al., 2021). The health behaviors of HCPs can directly influence the health behaviors of the general population through the advice and care they provide. For instance, an HCP who adheres to healthy dietary practices and regular physical activity is more likely to counsel patients effectively on adopting similar habits, thereby having a broader impact on public health (Reeves et al., 2013). Conversely, if HCPs themselves are struggling with poor lifestyle choices, this could undermine their credibility and the efficacy of their health-promoting interventions (Downing et al., 2021).

The theoretical framework underlying this study is grounded in public health and health psychology theories that explore the intricate relationship between lifestyle, occupation, and mental health. The job demands-resources (JD-R) model (Bakker & Demerouti, 2007) is particularly relevant in this context, as it posits that the high demands placed on HCPs–such as long working hours, emotional stress, and the pressure to provide high-quality care–can lead to burnout and mental health issues. These mental health challenges, in turn, may adversely affect their lifestyle choices, including their dietary habits and physical activity levels (Schaufeli & Taris, 2014). Research has shown that burnout among HCPs is associated with unhealthy behaviors such as increased consumption of fast food, reduced physical activity, and higher rates of smoking and alcohol use (Toker & Biron, 2012). This model highlights the importance of addressing both the occupational stressors and lifestyle behaviors of HCPs to improve their overall health and well-being.

Furthermore, social cognitive theory (Bandura, 1986) suggests that HCPs' own health behaviors can significantly influence their effectiveness in promoting healthy behaviors in their patients. According to this theory, behavior change is influenced by the interaction between personal factors (such as beliefs, attitudes, and knowledge), behavioral factors (such as skills and practices), and environmental factors (such as social support and access to resources). In the context of the MENA region, where cultural and societal norms may differ significantly from those in the West, it is essential to understand how these factors interplay to shape the health behaviors of HCPs (Aljefree & Ahmed, 2015). For example, in some MENA countries, there may be strong cultural taboos against certain dietary practices or a lack of infrastructure to support physical activity, which could influence both the personal health behaviors of HCPs and the health advice they provide to their patients (Ghaderi et al., 2018).

This study aims to fill the gap in the literature by determining the prevalence of NCDs among HCPs in the MENA region, including CVD, diabetes mellitus (DM), malignancies, and psychiatric disorders. It also seeks to assess the adherence of HCPs to healthy dietary habits and physical activity. Given the dual role of HCPs as both caregivers and health role models, understanding their health behaviors and the prevalence of NCDs within this group is crucial. The findings from this study will not only provide valuable insights into the burden of NCDs among HCPs in the MENA region but also inform the development of workplace wellness programs and public health strategies tailored to the unique needs of this population. Such interventions could help mitigate the risk of NCDs among HCPs and enhance their capacity to serve as effective advocates for healthy lifestyles within their communities (WHO, 2020).

By highlighting the differences between HCPs in the MENA region and those in Western countries, this study emphasizes the importance of context-specific research in understanding and addressing the health challenges faced by HCPs. Such research is crucial for developing effective interventions that can enhance the overall health and well-being of HCPs, ultimately benefiting the wider community.

MATERIALS AND METHODS

Study design

This is a multicenter cross-sectional study in which data were collected through an online questionnaire designed using Google Forms, given the simple format and ease of data collection. Paper questionnaires were distributed in nine countries, and the data were copied to form Excel sheets. Only HCPs (full-time, part-time, or casual) in the following five categories were allowed to complete the questionnaire: physicians, pharmacists, nurses, dentists, and nutritionists). Ethical approval was obtained from countries where the questionnaire was published. All HCPs were introduced to the study's aims and objectives and were sent the study proposal for further information. Participants understood that responding to the study questionnaire was for this study, not for local hospital governance, for example.

Sampling

The sample size for this study was calculated according to Epi Info version 7.2.4.0 at a 5% margin of error, 95% confidence interval, and 50% frequency of outcome factor in the population, with a minimum of 380 participants from each country. The population density data of the healthcare workers in each country were obtained through the Global Health Workforce statistics database as we could not attain official data specifying the accurate number of HCPs in any of the targeted countries (Global Health Workforce statistics database). We used convenience and snowball sampling methods, in which we collected the data from participants who were accessible to fill out the questionnaire.

Survey questionnaire design

We used a Google Form questionnaire designed by Mittal et al. to identify the dietary patterns of HCPs, along

with their physical exercise habits throughout the day/week. This questionnaire combined questions from the University of Leeds short-form food frequency questionnaire (SFFFQ) (Cleghorn, 2016) to test the dietary intake of every participant from each food group per day/week. For the physical activity section, questions were used from the standard short international physical activity questionnaire (IPAQ) (International Physical Activity Questionnaire). A few modifications were made to suit our objectives, yet we acknowledge that bias might exist due to the substantially different sociocultural differences and behavioral factors between the UK population where the questionnaire was designed and the population targeted in this study. We obtained an expert's view to modify the questionnaire for statistical analysis.

The study investigators recruited HCPs from 11 countries in the MENA region (Algeria, Egypt, El Yemen, Iraq, Jordan, Kuwait, Libya, Palestine, Saudi Arabia, Sudan, and Syria) through their national societies or by direct personal contact. The study was conducted in such countries as they met the sample size requirements and had suitable facilities to collect data. HCPs who agreed to participate in the study were asked to complete a questionnaire about their dietary and exercise patterns. Our survey was available in both English and Arabic language and was accessible online and offline. An invitation with the online survey link was shared on social media platforms and online community networks. No contact details of any participant were collected. Therefore, no personal contact was made with any participant. The participants voluntarily decided to complete the questionnaire.

Study tool

The study utilized a structured survey questionnaire, which was adapted from a previous study conducted in the United Kingdom (Mittal et al., 2018). The data collection process encompassed several key areas. Firstly, demographic information was gathered, including participants' age, gender, country of residence, job role, height, and weight. Secondly, the survey addressed risk factors and medical conditions by asking participants to self-report any comorbidities associated with cardiovascular diseases (CVDs). Thirdly, the questionnaire explored dietary habits, with detailed questions about the frequency of specific food categories consumed throughout the day or week. Lastly, the survey examined physical activity, focusing on the type and frequency of low-, moderate-, and high-intensity activities that participants engaged in during the week.

Ethics

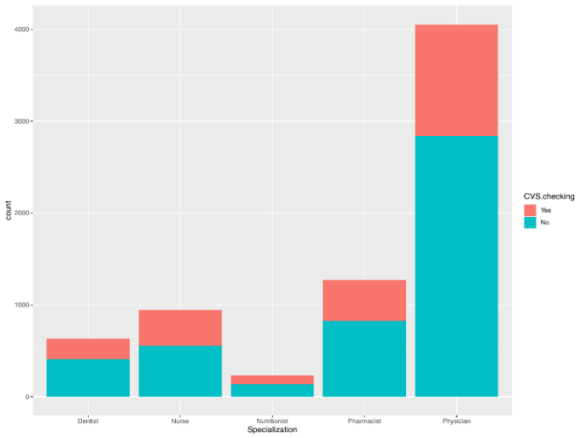
Data were collected anonymously, and no identifying information was obtained from this online survey. Participants could withdraw their answers after submitting their questionnaire, but they only had the opportunity to do so before or while submitting the questionnaire. The study participants did not benefit directly from the project. However, the data collected from this study aimed to assess the cardiovascular state of HCPs based on their diet and physical activity, create awareness regarding the current state of HCPs in the MENA region and help modify their lifestyle habits. There were no foreseeable risks for participants in this study. The study was approved by the Institutional Review Board Committee at Al-Razi University in Yemen; Al-Quds University in Jerusalem, Palestine; and Minia University in Egypt. The study and analysis maintained the participants' privacy and anonymity.

Statistical analysis

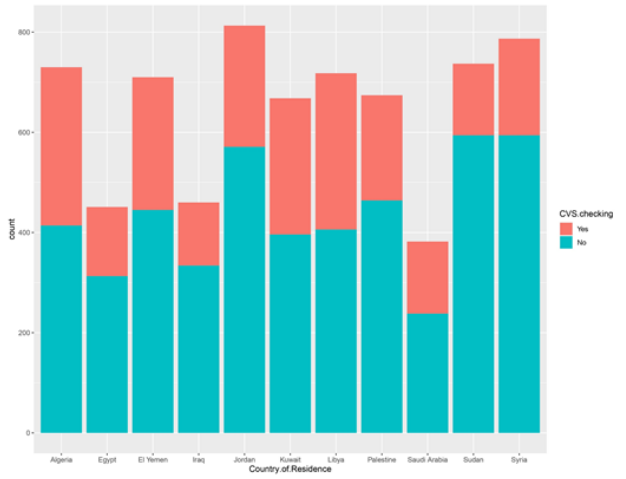
Statistical analysis was performed using R Statistical Software (v4.1.3; R Core Team 2022). The adjusted odds ratio (ORs) and 95% confidence intervals (CIs) were calculated, and statistical significance was determined as $p < 0.05$. A demographics table was formed with the mean and standard deviation for age and body mass index (BMI) calculated across countries. Eight multivariable regression models using the enter regression procedure for variable selection were applied to confirm the determinants of diet and physical activity. In the first five regression models, the independent variables included all CVDs mentioned in the questionnaire: high blood pressure, cholesterol, angina, peripheral vascular disease, heart attack, stroke, cancer, diabetes, anxiety, depression, and stress experience. The dependent variables in the first five models included alcohol, pork, smoking, soda, and sugar, which represented the food items most significantly associated with CVDs. The other three models were applied to confirm the determinants of physical activity. Independent variables included all CVDs previously mentioned in the first five models, while dependent variables included vigorous exercise, moderate exercise, and walking.

RESULTS AND DISCUSSION

A total of 7130 HCPs from the Middle East completed this questionnaire, among which 1030 participants (14%) filled it in a paper form, with Jordan and Syria showing the highest participation rate. The demographics table divides the participants of each country according to age, gender, specialization, BMI, cardiovascular system checking (CVS_check), and self-description of health and smoking status. The mean age of the participants was 28.6 ± 7.8 years, with males comprising 42.5% of the total participants (Fig 1a) (Table 1). The majority of participants were physicians (56.8%), followed by pharmacists (17.8%), nurses (13.2%), dentists (8.8%), and nutritionists (3.3%). Overall, 2361 participants reported having a history of CVD, cancer, diabetes mellitus (DM), anxiety, depression, or stress. This accounted for 33.1% of the studied population (Fig 1b) (Table 1). Only 2% of the participants reported having current poor health, while 44.7% described themselves as having a good health status (Fig 1c) (Table 1).



(a)



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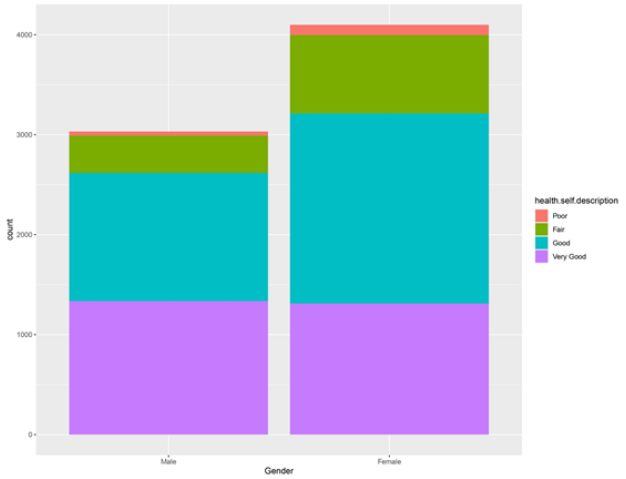


(c)

Figure 1. Demographic Pattern. (a) Self-description of health per gender; (b) Cardiovascular system check per specialization; (c) Cardiovascular system check per country.

Table 1 presents the baseline demographic characteristics of the study population across several countries in the Middle East and North Africa (MENA) region, including Algeria, Egypt, Yemen, Iraq, Jordan, Kuwait, Libya, Palestine, Saudi Arabia, Sudan, and Syria. The data indicate significant variations in various demographic aspects among healthcare professionals in this region. The mean age of participants ranges from 24.2 years in Iraq to 33.0 years in Kuwait, with an overall mean age of 28.6 years. This reflects considerable age diversity among the participants. In terms of gender, females are more prevalent in the overall study population (57.5%), although the proportion of males is much higher in Yemen (78.7%), while females dominate in Libya (78.0%).

Regarding specialization, the majority of participants are physicians (56.8%), followed by pharmacists (17.8%) and nurses (13.2%). Participation in specific specializations varies significantly between countries. For instance, pharmacists are the majority in Yemen (61.8%), while in Jordan, most participants are physicians (74.3%). The average Body Mass Index (BMI) of participants also varies, with the lowest mean in Syria (23.5) and the highest in Saudi Arabia (27.1). The overall mean BMI is 24.8, indicating a varied distribution of body weight among participants from different countries.

Only 33.1% of all participants reported undergoing cardiovascular (CVS) checks, with the lowest proportion in Sudan (19.4%) and the highest in Libya (43.5%). Most participants described their health as "Good" (44.7%) or "Very Good" (37.1%), although there were significant differences between countries, such as Palestine and Saudi Arabia, where the highest percentages described their health as "Very Good." Regarding smoking status, the majority of participants (83.2%) reported not smoking. However, Palestine (29.4%) and Syria (26.9%) have the highest proportions of smokers, while Algeria and Sudan have the lowest percentages (7.1% and 7.9%, respectively).

Overall, the data reveal significant demographic variability among healthcare professionals in the MENA region. Factors such as age, gender, specialization, BMI, health checks, and smoking habits show clear differences between countries. This variability is important to consider when planning health interventions in each country to improve adherence to dietary habits and physical activity, as well as to reduce the prevalence of non-communicable diseases in the region.

Reports of anxiety, depression, and stress were the highest among HCPs (35.9%), followed by high blood pressure (7.9%), high cholesterol levels (6.3%), diabetes (2.7%), peripheral vascular disease (1.8%), angina (1%), heart attack (0.9%), cancer (0.5%), and stroke (0.2%) (Table 2).

Eating habits

Alcohol consumers showed significantly increased odds of heart attack, by 4.31-fold (OR = 4.31 [1.64–9.68, p = 0.001]), in both univariate and multivariate models and increased odds of stroke occurrence, by 6.49-fold (OR = 6.49 [1.00–24.37, p = 0.015]), in the univariate model only (Fig 2a) compared to non-consumers of alcohol. Pork consumers, in contrast, showed significantly increased odds of having peripheral vascular disease, by 2.78-fold (OR = 2.78 [1.43–4.96, p = 0.001]), and significantly decreased odds of having anxiety, depression, or stress, by 24% (OR = 0.76 [0.58–0.99, p = 0.043]). In the univariate model only, pork consumers showed significantly increased odds of having a stroke, heart attack, angina, or diabetes, by 7.88-fold (OR = 7.88 [1.76–25.94, p = 0.002]), 3.25-fold (OR = 3.25 [1.34–6.73, p = 0.004]), 2.40-fold (OR = 2.40 [0.92–5.14, p = 0.043]), and 1.77-fold (OR = 1.77 [0.92–3.08, p = 0.061]), respectively, compared to non-consumers of pork (Fig 2e).

Smoking showed the most significant associations with CVDs compared to the other dependent variables, where smokers represented 16.8% of the total population. They showed significantly increased odds of having high blood pressure, cholesterol, or angina, by 1.33-fold (OR = 1.33 [1.07–1.65, p = 0.010]), 1.57-fold (OR = 1.57 [1.23–1.97, p < 0.001]), and 1.88-fold (OR = 1.88 [1.08–3.19, p = 0.022]), respectively. However, they showed significantly decreased odds of having peripheral vascular disease, by 43% (OR = 0.57 [0.32–0.95, p = 0.040]), compared to non-smokers. In the univariate model for smoking, smokers also showed significantly increased odds of heart attack, by 2.11-fold (OR = 2.11 [1.20–3.56, p = 0.007]), and diabetes, by 1.73-fold (OR = 1.73 [1.23–2.38, p = 0.001]) (Fig 2d).

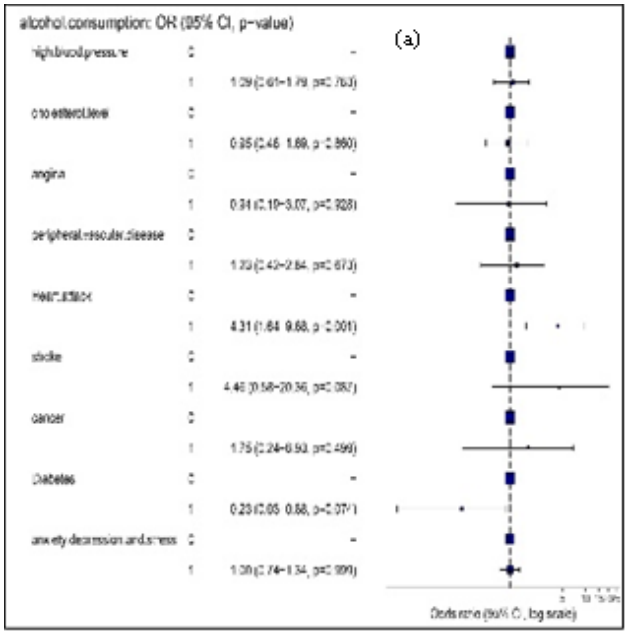
Table 1
Baseline demographic characteristics among the study population

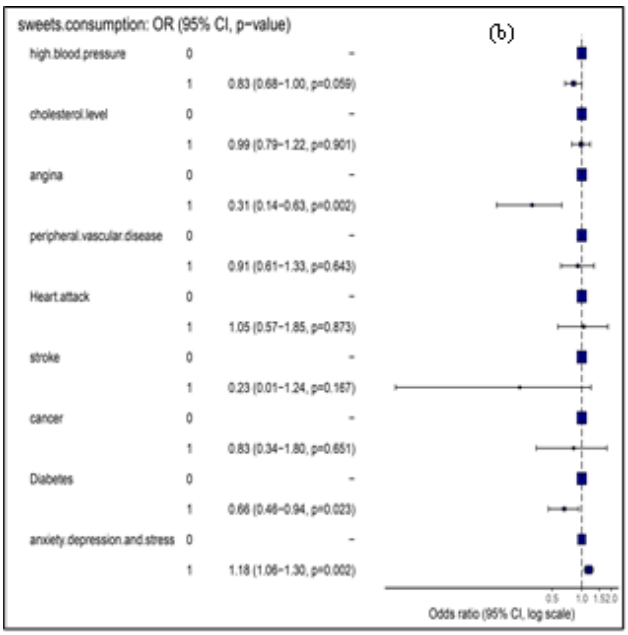
Demographics		Algeria	Egypt	El Yemen	Iraq	Jordan	Kuwait	Libya	Palestine	Saudi Arabia	Sudan	Syria	Total	p
Age	Mean (SD)	29.0 (8.2)	27.4 (6.2)	30.5 (9.4)	24.2 (5.4)	27.6 (7.1)	33.0 (9.3)	29.9 (7.7)	29.1 (7.9)	31.0 (8.9)	27.2 (4.5)	26.1 (6.5)	28.6 (7.8)	<0.001
Gender	Male	216 (29.6)	176 (39.0)	559 (78.7)	163 (35.4)	310 (38.1)	263 (39.4)	158 (22.0)	346 (51.3)	223 (58.4)	214 (29.0)	403 (51.2)	3031 (42.5)	<0.001
	Female	514 (70.4)	275 (61.0)	151 (21.3)	297 (64.6)	503 (61.9)	405 (60.6)	560 (78.0)	328 (48.7)	159 (41.6)	523 (71.0)	384 (48.8)	4099 (57.5)	
Specialization	Dentist	105 (14.4)	16 (3.5)	54 (7.6)	46 (10.0)	38 (4.7)	73 (10.9)	69 (9.6)	31 (4.6)	27 (7.1)	89 (12.1)	83 (10.5)	631 (8.8)	<0.001
	Nurse	82 (11.2)	42 (9.3)	51 (7.2)	103 (22.4)	54 (6.6)	107 (16.0)	335 (46.7)	61 (9.1)	59 (15.4)	27 (3.7)	22 (2.8)	943 (13.2)	
	Nutritionist	41 (5.6)	8 (1.8)	40 (5.6)	31 (6.7)	27 (3.3)	25 (3.7)	8 (1.1)	27 (4.0)	10 (2.6)	11 (1.5)	4 (0.5)	232 (3.3)	
	Pharmacist	62 (8.5)	112 (24.8)	439 (61.8)	51 (11.1)	90 (11.1)	97 (14.5)	147 (20.5)	68 (10.1)	49 (12.8)	59 (8.0)	98 (12.5)	1272 (17.8)	
	Physician	440 (60.3)	273 (60.5)	126 (17.7)	229 (49.8)	604 (74.3)	366 (54.8)	159 (22.1)	487 (72.3)	237 (62.0)	551 (74.8)	580 (73.7)	4052 (56.8)	
BMI	Mean (SD)	24.0 (4.1)	26.0 (5.1)	24.0 (5.0)	24.4 (5.4)	25.1 (4.6)	26.5 (5.5)	24.8 (5.3)	25.2 (4.8)	27.1 (6.2)	24.1 (5.1)	23.5 (4.0)	24.8 (5.0)	<0.001
CVS Checking	Yes	316 (43.3)	138 (30.6)	265 (37.3)	126 (27.4)	242 (29.8)	272 (40.7)	312 (43.5)	210 (31.2)	144 (37.7)	143 (19.4)	193 (24.5)	2361 (33.1)	<0.001
	No	414 (56.7)	313 (69.4)	445 (62.7)	334 (72.6)	571 (70.2)	396 (59.3)	406 (56.5)	464 (68.8)	238 (62.3)	594 (80.6)	594 (75.5)	4769 (66.9)	
Health Self Description	Poor	21 (2.9)	8 (1.8)	9 (1.3)	24 (5.2)	11 (1.4)	17 (2.5)	19 (2.6)	4 (0.6)	3 (0.8)	24 (3.3)	4 (0.5)	144 (2.0)	<0.001
	Fair	172 (23.6)	92 (20.4)	69 (9.7)	118 (25.7)	95 (11.7)	101 (15.1)	142 (19.8)	68 (10.1)	50 (13.1)	162 (22.0)	87 (11.1)	1156 (16.2)	
	Good	414 (56.7)	226 (50.1)	289 (40.7)	228 (49.6)	323 (39.7)	365 (54.6)	244 (34.0)	297 (44.1)	132 (34.6)	317 (43.0)	350 (44.5)	3185 (44.7)	
	Very Good	123 (16.8)	125 (27.7)	343 (48.3)	90 (19.6)	384 (47.2)	185 (27.7)	313 (43.6)	305 (45.3)	197 (51.6)	234 (31.8)	346 (44.0)	2645 (37.1)	
Smoking Status	Yes	52 (7.1)	25 (5.5)	120 (16.9)	71 (15.4)	210 (25.8)	127 (19.0)	57 (7.9)	198 (29.4)	68 (17.8)	58 (7.9)	212 (26.9)	1198 (16.8)	<0.001
	No	678 (92.9)	426 (94.5)	590 (83.1)	389 (84.6)	603 (74.2)	541 (81.0)	661 (92.1)	476 (70.6)	314 (82.2)	679 (92.1)	575 (73.1)	5932 (83.2)	

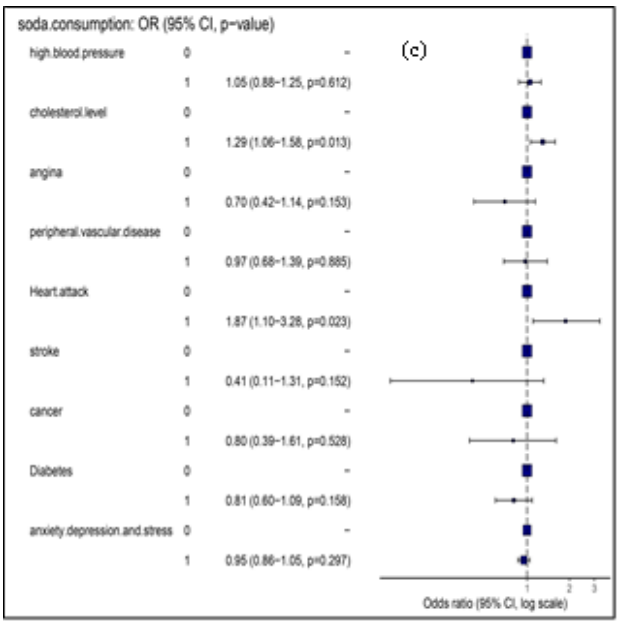
Soda consumers showed significantly increased odds of having high cholesterol, by 1.29-fold (OR = 1.29 [1.06–1.58, p = 0.013]), and heart attack, by 1.66-fold (OR = 1.66 [1.01–2.82, p = 0.051]), compared to non-consumers of soda (Fig 2c), while sugar consumers showed significantly decreased odds of having angina and diabetes, by 69% (OR = 0.31 [0.14–0.63, p = 0.002]) and 34% (OR = 0.66 [0.46–0.94, p = 0.023]), respectively. Sugar consumers still showed significantly increased odds of having anxiety, depression, and stress, by 1.18-fold (OR = 1.18 [1.06–1.30, p = 0.002]), compared to non-consumers of sugar. In the univariate model for sugar consumption, sugar consumers showed significantly decreased odds of having high blood pressure, by 23% (OR = 0.77 [0.63–0.92, p = 0.006]) (Fig 2b).

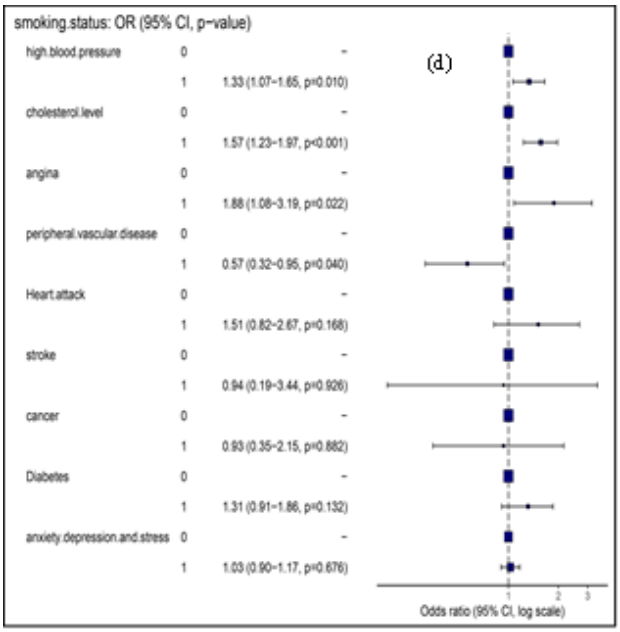
Table 2
Number of people reporting cardiovascular diseases across all countries

Type of Disease	Disease Status	Total Number
High blood pressure	0	6566 (92.1)
	1	564 (7.9)
High Cholesterol	0	6682 (93.7)
	1	448 (6.3)
Angina	0	7058 (99.0)
	1	72 (1.0)
Peripheral.vascular.disease	0	7001 (98.2)
	1	129 (1.8)
Heart attack	0	7066 (99.1)
	1	64 (0.9)
Stroke	0	7117 (99.8)
	1	13 (0.2)
Cancer	0	7096 (99.5)
	1	34 (0.5)
Diabetes	0	6938 (97.3)
	1	192 (2.7)
Anxiety.depression.and.stress	0	4568 (64.1)
	1	2562 (35.9)









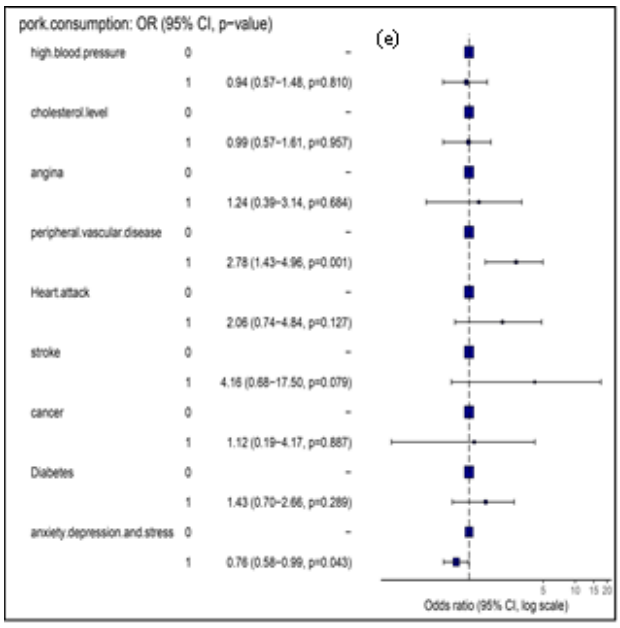


Figure 2. Forest plots showing the association between dietary habits and non-communicable diseases. (a) Estimating the association between alcohol consumption and CVD, DM, malignancy and psychiatric disorders; (b) Estimating the association between sweets consumption and CVD, DM, malignancy and psychiatric disorders; (c) Estimating the association between soda consumption and CVD, DM, malignancy and psychiatric disorders; (d) Estimating the association between smoking and CVD, DM, malignancy and psychiatric disorders; & (e) Estimating the association between pork consumption and CVD, DM, malignancy and psychiatric disorders.

Physical activity

The higher percentage was for those not practicing sports. Most HCPs (50% and above) performed <75 min of vigorous exercise, <150 min of moderate exercise, and <150 min of walking or mild exercise per week across all categories. Nutritionists had the most physical activity in all three categories. For example, 14.7% of nutritionists dedicated 150 min or more per week to moderate exercise compared to 8.8%, 9.4%, 9.6%, and 10.6% among pharmacists, nurses, physicians, and dentists, respectively (Table 3).

The odds of having angina in people performing vigorous exercise were significantly decreased, by 72% (OR = 0.28 [0.10–0.65, p = 0.007]). However, they showed significantly increased odds of having a heart attack, by 2.11-fold (OR= 2.11 [1.16–3.73, p = 0.011]), and stroke, by 5.88-fold (OR = 5.88 [1.79–20.61, p = 0.004]). In the univariate model for vigorous exercise performance, they showed decreased odds of having high cholesterol, by 24% (OR = 0.76 [0.58–0.98, p = 0.038]), compared to participants who did not practice 75 min or more of vigorous exercise per week (Fig 3b). Moderate exercise resulted in no significant increase or decrease in the odds of developing CVDs (Fig 3a). Finally, people practicing mild exercise or walking showed significantly increased odds of having anxiety, depression, and stress, by 1.12-fold (OR = 1.12 [1.02–1.24, p = 0.022]), compared to participants who did not walk. However, the univariate model for walking showed significantly decreased odds of having high blood pressure and high cholesterol levels, by 17% (OR = 0.83 [0.69–0.99, p = 0.035]) and 20% (OR = 0.80 [0.66–0.98, p = 0.031]), respectively (Fig 3c).

This multicenter cross-sectional study targeted HCPs to study the incidence and association of dietary habits and exercise with the development of CVD mainly, as well as DM, malignancy, anxiety, and depression to a lesser extent. Alcohol, pork, soda, and sugar consumers showed significant increases in odds of having CVD at some point in their lives compared to non-consumers of such food items. Smokers showed the highest odds of developing CVD among all items provided in the questionnaire. Our results suggest that HCPs neglect doing exercise frequently, which may be due to their hectic lives. It must be emphasized to HCPs that modifying eating habits and having an exercise schedule can promote performance and enhance health after having a non-communicable disease.

The dietary habits of participants were compared with the dietary guidelines for macronutrients and the food-based dietary guidelines of the American Heart Association, the National Health Service (NHS), and the Dietary Approaches to Stop Hypertension (American Heart Association, 2024). However, in alcohol and pork consumption, our reference value was zero for both items since they are not commonly consumed in Arab and Islamic countries for religious considerations. Physical activity guidelines set by the World Health Organization (World Health Organization, 2024). were used to determine the appropriate intensity and duration of exercise.

The results of this study show that anxiety, depression, and stress are very common among healthcare professionals (HCPs) in the Middle East. Among these professionals, 35.9% reported having these conditions. This is concerning because mental health issues, such as chronic stress and mental health disorders, can have far-reaching effects on cognitive function, decision-making, and overall job performance. As a result, the quality of patient care could be affected. Additionally, HCPs who suffer from anxiety and depression are more likely to experience burnout, which can lead to absenteeism, reduced productivity, and an increased likelihood of medical errors. Therefore, there is an immediate need for targeted interventions to support the mental health of HCPs, which could help improve patient care.

Table 3
Activity level per specialization (10 pt)

Type of Exercise	Exercise Duration/mins	Dentist	Nurse	Nutritionist	Pharmacist	Physician	Total	p
Vigorous Exercise	<75	493 (78.1)	738 (78.3)	172 (74.1)	1021 (80.3)	3272 (80.8)	5696 (79.9)	0.049
	>=75	138 (21.9)	205 (21.7)	60 (25.9)	251 (19.7)	780 (19.2)	1434 (20.1)	
Moderate Exercise	<150	564 (89.4)	854 (90.6)	198 (85.3)	1160 (91.2)	3661 (90.4)	6437 (90.3)	0.08
	>=150	67 (10.6)	89 (9.4)	34 (14.7)	112 (8.8)	391 (9.6)	693 (9.7)	
Walking	<150	394 (62.4)	604 (64.1)	127 (54.7)	804 (63.2)	2260 (55.8)	4189 (58.8)	<0.001
	>=150	237 (37.6)	339 (35.9)	105 (45.3)	468 (36.8)	1792 (44.2)	2941 (41.2)	

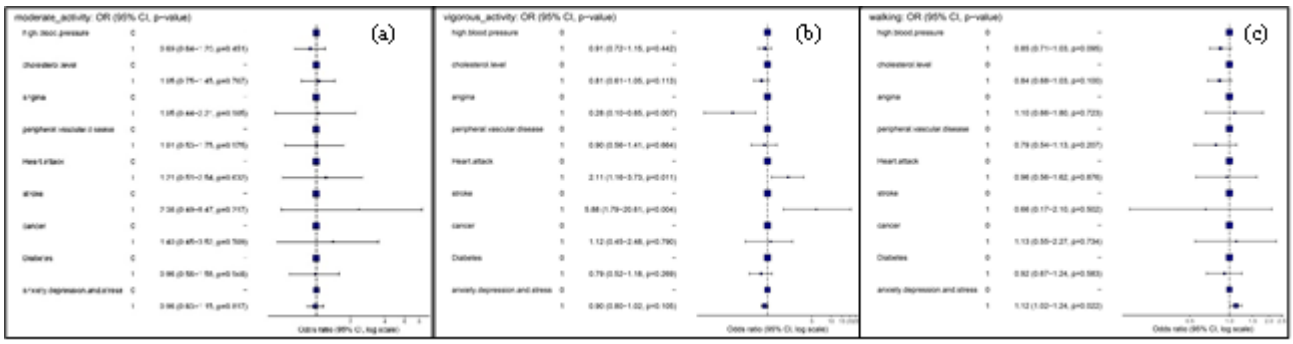


Figure 3. Forest plots showing the association between physical activity and non-communicable diseases. (a) Estimating the association between moderate exercise and CVD, DM, malignancy and psychiatric disorders; (b) Estimating the association between vigorous exercise and CVD, DM, malignancy and psychiatric disorders; (c) Estimating the association between walking exercise and CVD, DM, malignancy and psychiatric disorders.

Important insights regarding HCP health behaviours are also provided by the correlation between lifestyle variables and CVDs that this research found. The risk of cardiovascular events, such as heart attacks and strokes, was shown to be much higher among those who consumed alcohol. According to these findings, healthcare providers are not only more likely to engage in poor lifestyle choices, but these decisions also put their cardiovascular health at serious danger. The health advice that healthcare providers provide to their patients may be impacted by their own health habits, since they are supposed to be role models for good living. The harmful effects of alcohol on cardiovascular function, cholesterol levels, and blood pressure are possible processes that underlie these correlations. Wellness programs in the workplace and other health promotion efforts might help HCPs lead healthier lives and gain patients' trust in their health recommendations by addressing these lifestyle issues.

Alcohol consumers showed significantly increased odds of heart attack (or myocardial infarction [MI]), by 4.31-fold, compared to non-consumers of alcohol (Fig 2a). This can be explained by a systematic review conducted on alcohol and the immediate risk of cardiovascular events. Participants reported an immediate association between MI and alcohol consumption in nine different case-crossover and case-control studies, with heavy drinkers reporting the highest risk among participants, ingesting approximately nine drinks per day, as a single dose of alcohol might increase heart rate, interarterial electromechanical delay, and plasminogen activator inhibitor levels within one to three hours of consumption (Mostofsky et al., 2016).

The 2016 Global Burden of Diseases, Injuries, and Risk Factors Study supports our reference value of zero for alcohol consumption (GBD 2016 Alcohol Collaborators, 2018). It concludes that after 26 years of follow-up, the safest amount of alcohol to ingest to minimize the risk of all-cause mortality is 0 IU per week (95% IU 0.0–0.8). This value is further supported by a recent study on rats to investigate the epigenomic and transcriptomic brain changes upon acute ethanol exposure. Researchers were surprised to find that even the smallest amount of alcohol-induced epigenetic changes in the brain create a pathway for addiction (Krishnan et al., 2022).

We found no data supporting our results for pork consumers who showed significantly increased odds of having peripheral vascular disease and significantly decreased odds of having anxiety, depression, or stress (Fig 2e).

Regarding added sugar, which is often a significant component of soda, a prospective cohort study published in 2014 confirmed the association between the consumption of added sugar and increased CVD mortality (Yang et al., 2014). However, insufficient data were available to eliminate the conflicting results on the relationship between added sugar and CVD (Carbone et al., 2019).

Our results suggest that the odds of consuming sugar while having a history of diabetes decreased by 34%, which may be due to awareness of the consequences of sugar consumption on diabetes development (Fig 2b). However, sugar consumers showed significantly increased odds of having anxiety, depression, or stress, by 1.18-fold, suggesting that these psychiatric disorders can be either a cause or a result of sugar consumption. Such an explanation is supported by a Spanish cross-sectional study on university students that reports a significant association ($p < 0.05$) between excessive intake of sugars as well as low consumption of dairy products and the prevalence of psychiatric disturbances, namely, anxiety, depression, and stress (Ramón-Arbués et al., 2019).

The results of studies on smoking support that smoking increases the risk of CVD, especially atherosclerotic CVD (ASCVD) (Carbone et al., 2019), so it is not uncommon for smokers to show increased odds of having angina, cholesterol, and high blood pressure compared to non-smokers. Further, the odds of developing peripheral vascular disease while being a smoker were reduced by 43% compared to non-smokers, yet we currently have no explanation for this result (Fig 2d).

Regarding physical activity, the association between performing vigorous exercise for 75 min or more per week and having a history of stroke can be explained by the fact that high cardiorespiratory fitness, achieved through exercise, predicts a lower risk of developing a subsequent stroke event among patients who exercise for at least one month after their first event. The effects of cardiorespiratory training include regulating blood pressure, lowering cholesterol, and improving arterial function, all of which help sustain a healthy cardiovascular system (Saunders et al., 2014).

This explanation supports our univariate model results for people who walk for 150 min or more per week, as they showed significantly decreased odds of having high blood pressure, by 17%, and high cholesterol, by 20%. Interestingly, walking was present more often in people with anxiety, depression, or stress, with odds of 1.12; we believe these people enjoy walking as a form of relief from anxiety, depression, and stress.

A study performed in the United Kingdom on a group of hospital staff revealed low adherence to the dietary

guidelines recommended by the NHS in The Eatwell Guide and an inactive lifestyle among most HCPs. Our study goes hand in hand with some of the findings mentioned above, as we found poor compliance with the dietary guidelines set by the American Heart Association, with 2361 HCPs experiencing CVD (Fig 1c).

It is crucial for HCPs to understand the consequences of leading an unhealthy on both personal and societal levels. Proper dietary and exercise habits are more likely to persuade patients upon advice (Brehm et al., 2016). Further, education through nutritional training programs can help implement a healthy lifestyle that is more manageable given the busy life routine of HCPs that has been ongoing since they attended college (Bede et al., 2020). Hence, having only the theoretical knowledge of how to lead a healthy life does not necessarily help in applying it (Betancourt-Nuñez et al., 2018).

The limitations of cross-sectional studies are well known in the literature. As we used a virtual snowball sampling method, we had no control over the survey sample population or size, and the response rate is unknown. Further, we could not follow up with non-responders. However, the survey attracted many respondents across the targeted HCP categories, with a good spread across high-income countries and low- and middle-income countries and a reasonable sex distribution.

Errors are expected in self-reported questionnaires, as in ours, for example, where participants fail to determine the accurate portions of their meals or evaluate the time they spend exercising throughout the week. In similar studies, information regarding hydration status can be implemented in further questionnaires, as hydration represents a crucial indicator for future heart failure or left ventricular hypertrophy (National Institutes of Health, 2022). In addition, fasting frequencies and durations can be added to strengthen the current belief in intermittent fasting and to promote cardiovascular health (Dong et al., 2020). Further, the lag time between the development of CVD and the appearance of symptoms should not be overlooked when designing studies related to CVD health and lifestyle, as the resultant mortality rates we find today are a consequence of factors that have been overlooked in the past (Gaziano, 2005). Assessing the probability of developing CVD due to current eating and exercise behaviors using online tools such as the ASCVD Risk Estimator Plus provided by the American College of Cardiology should be implemented in future studies (ASCVD Risk Estimator Plus).

CONCLUSIONS

This cross-sectional study sheds light on the health status of HCPs in the MENA region in relation to their food and exercise habits. Alcohol, pork, soda, and sugar consumers showed significant increases in the odds of having CVDs at some point in their lives compared to non-consumers of such products. Smokers showed the highest odds of developing CVDs among all items provided in the questionnaire. Further, exercise frequency and intensity are better monitored by professional coaches, especially for people with a medical history of CVD, to avoid the aggravation of past or current medical conditions with vigorous exercise. It must be emphasized to HCPs that modifying eating habits and having an exercise schedule can promote performance and enhance health.

DECLARATIONS

Ethics approval and consent to participate

Informed consent was waived by the Institutional Review Board Committee (IRB) of Al-Razi University in Yemen; Al-Quds University in Jerusalem, Palestine; and Minia University in Egypt. The study and analysis maintained the participants' privacy and anonymity. All methods were performed in accordance with the relevant institutional guidelines and regulations.

No patients or members of the public were involved in the design, conduct, report or dissemination plans of the research. Participants only filled the questionnaires distributed by the authors, co-authors and collaborators.

Competing/Conflict of interests Statement

The authors declare no conflict of interest

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Authors' contributions

Nael Kamel Eltewacy: Questionnaire Design, Web-Survey Design, Supervised the Data Collection Process, And Checked Writing, Approved Methodology, Manuscript Editing and Supervised All Steps;
Nada Abdelhalim: Researched Literature, Questionnaire Design, And Web-Survey Design, Coordinate and Monitor the Data Collection Process with Collaborators, Wrote the First Draft of The Manuscript;
Nouran Hamza: Final Questionnaire and Paper Revision;
Tarek A. Owais: Interpret Data, Organizing and Data Arrangement, Coded Data, Involved in Statistical Analysis, Designed Figures, Checked Writing;
Saif Salman: Manuscript Editing;
Sheikh Mohammed Shariful Islam: Final Editing, Reviewing, And Supervising the Steps.

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Availability Of Data And Materials

The article and supplementary materials contain the original contributions discussed in the study. Original datasets are available upon reasonable request from the corresponding author.

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